paragraph which closes with the following sentence: "There are decided objections to complication in any form of apparatus which may receive rough treatment in transportation and which is frequently handled carelessly by its operators." It is surprising to note that the author gives preference to a form of apparatus because it is able to withstand "rough treatment" and "careless handling," when it has repeatedly been shown that the apparatus gives erroneous results.

The chapter on exact gas analysis contains a description of two burettes designed by the author. The bulbed gas burette is an improvement over the Pettersson-Hempel gas burette for exact gas analysis with respect to the accuracy with which gas volumes may be read.

Under the methods for the determination of the heating value of a gas, the Junkers calorimeter is taken up in detail, brief mention is made of the Hempel, Graefe, Parr, and Doherty calorimeters, and one paragraph is devoted to the discussion of automatic and recording gas calorimeters. The material in this chapter is excellent. The use of the definition of what is known usually as "total" heating value to define the "gross" heating value is confusing, especially since later in the chapter there is given a table of corrections to obtain the "total" heating value from the observed or "gross" heating value. This chapter also includes a description of the sling psychrometer for determining moisture in air, since the moisture content is one of the variables upon which the value of the above correction depends. The whirling psychrometer is not mentioned.

There is a short chapter on the determination of suspended particles in gas, a subject which has hitherto not been given the prominence it deserves in books of this character. In the words of the author, this is a subject which "is daily becoming of greater importance on account of legal restrictions on pollution of the air and on account of insistence on closer control of industrial operations by manufacturers."

The remainder of the twelve chapters on gas analysis is devoted to a discussion of chimney gas, producer gas, illuminating gas and natural gas, including methods of analysis and the application and interpretation of the results.

The chapter on liquid fuels is short and not so comprehensive as one would expect from the title of the book.

Under coal analysis, there is one chapter on sampling, one on the chemical analysis and two on the determination of the heating value by various methods. Frequent references are made in these chapters to the results of the investigations of the Joint Committee on Coal Analysis of the American Chemical Society and the Society for Testing Materials, of the Bureau of Mines and of the Bureau of Standards.

Typographical errors occur occasionally, *e. g.,* Ernshaw for Earnshaw, page 81, napthalene for naphthalene, pages 164 and 169, and Kjehldahl for Kjeldahl, page 210; there is a lack of punctuation, especially of commas, which renders some of the sentences ambiguous; peculiar constructions are present, *e. g.,* "Chapter II. describes the apparatus which the author believes best adapted to technical gas analysis and gives detailed directions for its manipulation," page 61, and "These gases (sulphur dioxide and sulphur trioxide) are absorbed, oxidized to sulphuric acid and weighed as barium sulphate," page 162; and finally, "estimation" is used throughout the book in place of "determination."

The book is well illustrated; all determinations that involve computations are clearly explained by the aid of concrete examples; and eight useful tables are appended at the close.

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October 24, 1913

PROFESSOR NOGUCHI'S RESEARCHES ON INFECTIVE DISEASES[1]

The Royal Society of Medicine mostly limits the record of its work to its own *Proceedings* and the medical journals; and it does well to observe this wise rule. But from

[1] From *Nature.*

time to time it receives some communication of the highest importance to the general welfare, and on such occasions it is mindful of its immediate duty to the public. It lately held a special meeting, at which Professor Noguchi, of the Rockefeller Institute, demonstrated the results of his researches into syphilis, general paralysis of the insane, epidemic infantile paralysis and rabies. None who heard Professor Noguchi and saw the great crowd of physicians and surgeons listening to him could fail to recognize the profound significance of this occasion.

No man of science works alone or in isolation: and a vast amount of cooperative work is being done in diverse parts of the world on what may be called the "higher types" of germs. Let us note the development of the work. Let us go back half a century, to the earliest methods of Pasteur. We may take 1855 as an approximate date for the beginning of the founding of "the germ-theory." For many years the only method which Pasteur had for the growth of germs in pure culture was the use of fluid media, such as broth; and, under the conditions of bacteriology fifty years ago, the use of these fluid media was full of difficulties. He had to wait until 1872 for the discovery that germs could be grown on solid media, such as gelatine or slices of potato. He had to wait until 1875 for the discovery that germs could be stained with aniline dyes so as to distinguish them, under the microscope, from their surroundings.

Pasteur lived until 1895—that is, ten years after the first use of his protective treatment against rabies, and two years after the first use in practise of diphtheria antitoxin—but he did not live to see more than the beginning of the study of the higher types of germs. At the time when he died, many of the lower types—the bacilli and the micrococci—had been discovered, isolated, grown in pure culture on solid media, and proven, by the inoculation of test animals, to be the very cause of this or that infective disease. But the higher types, such as the *plasmodium* of malaria, were still waiting to be worked out. Then, after Pasteur's death, came Ross's fine work on malaria; and then came two discoveries of no less importance—the discovery (Schaudinn, Hoffmann) of *Spirochæta pallida* in cases of syphilis, and the discovery (Forde, Dutton) of *Trypanosoma gambiense* in a case of sleeping sickness. These two discoveries brought syphilis and sleeping sickness, at last, within the range of practical bacteriology. Long ago, Moxon had said of syphilis that it was "a fever cooled and slowed by time"; but the cause of that fever was unknown until the *Spirochæta pallida* was discovered.

But to prove that it does not merely accompany, but actually causes the disease, it had to be grown in pure culture, and inoculated into test animals, producing in them some characteristic sign. Syphilis must be studied as diphtheria, tetanus, typhoid fever and tubercle had been studied. That is the meaning of all the work done by Ehrlich and his school upon salvarsan—that, in particles of tissue from a rabbit in which the disease has been produced, the *Spirochæta pallida* is present, under the microscope, before a dose of salvarsan, and is absent after it.

The work has been of immeasurable complexity, and there is much still to be done. There are many species of spirochætes discoverable in this or that condition of bodily life, besides *Spirochæta pallida;* indeed, Professor Noguchi demonstrated seven species. But he has cleared the way in this field of bacteriology. He has distinguished those which need some air for their growth from those which can not grow in air; he has discovered the method of adding a fragment of sterilized animal substance to each tube of pure culture: and these methods are of great value.

But that is not all. For he has detected *Spirochæta pallida* in the brain, in general paralysis of the insane. He has found it in twelve out of seventy specimens. There is no need to underline the importance of that statement.

Also, Professor Noguchi has obtained in pure culture the germs of anterior poliomyelitis (epidemic infantile paralysis). Of all the

many diseases of childhood in which the art of medicine, apart from its science, is of no great use, few are more unkind than infantile paralysis. It is the Rockefeller Institute that we must thank here. First came Flexner's magnificent work on epidemic cerebrospinal meningitis, and his discovery (1908) of the special antitoxin for that disease; then came the study of epidemic infantile paralysis. To have in one's hands, in a test-tube, infantile paralysis, is a grand experience for a man who has attended a children's hospital, year in year out, long before the Rockefeller Institute was born or thought of. It is enough to make him believe that the doctors some years hence may be able to stop the disease before it can inflict irremediable injury on the nerve cells of the spinal cord.

Finally, Professor Noguchi spoke of rabies (hydrophobia). He has been able to obtain, in pure culture, the microscopic bodies which Negri discovered in the brain in that disease. He demonstrated to the Royal Society of Medicine, on the lantern-screen, photographs showing the cycle—not unlike that of the *Plasmodium malariæ*—through which these bodies pass until, like miniature shrapnell, they break, setting free their constituent granules; and each granule becomes a "Negri body," and starts the cycle again. Happily, the protective treatment against rabies did not have to wait for the discovery of these Negri bodies. Pasteur worked at rabies, as Reed and Lazear worked at yellow fever, knowing that the virus was there, and able to control, fight and beat it, without seeing it under the microscope.

The Royal Society of Medicine deserves the thanks of the public for inviting Professor Noguchi to give this demonstration in London. He is indeed, in width and originality of work, equal to his fellow-countryman, Professor Kitasato. He has helped to make it possible for men of science to extend to other diseases those methods of study which brought about the discovery of diphtheria antitoxin and the protective treatments against cholera, typhoid fever and plague.

Stephen Paget

DIATOM COLLECTION OF THE UNITED STATES NATIONAL MUSEUM

Dr. Albert Mann, author of the "Report on the Diatoms of the *Albatross* Voyages in the Pacific Ocean" and many other diatom papers, has recently been appointed custodian of the diatom collection of the United States National Museum. This collection already contains much valuable material, including the types of species accumulated by the late Professor H. L. Smith, of Geneva, New York, the specimens of all the species of the *Albatross* diatoms, and the extensive collection of diatom material of the late Professor C. Henry Kain, of Philadelphia, representing the principal fossil deposits throughout the world as well as a large number of recent gatherings made in this country and abroad. To the large amount of material thus brought together, there are being added the marine diatoms of the Shackleton Expedition to the South Pole, diatoms recently secured in the Panama Canal Zone by the Smithsonian Institution, and the pelagic coastal diatoms of the Atlantic seaboard now being collected under the auspices of the Cambridge Zoological Laboratory and the United States Bureau of Fisheries.

For the accommodation of the extensive series of specimens thus assembled a separate room in the National Herbarium has been fitted up with cases, microscope accessories, and other necessary apparatus. The action of the National Museum in thus affording proper facilities for diatom study is in accordance with a growing realization of the importance of these organisms in modern science. Until recently they were appreciated mainly because of their artistic beauty and their interesting microscopical structure. They are now coming to be recognized as constituting one of the fundamental food supplies of the marine world and as having an important bearing on oceanography and recent geology.

Collectors who donate diatom specimens to the National Museum may be assured that their collections will be carefully preserved and made available to diatom students. The number of types already brought together is